

Nondefault

Chapter 7

Default

- Default = the use of any constant, equation, model, process, strategy, or evaluation as identified within the RISC Technical Guide
 - area screening
 - plume stability evaluation
 - closure sampling
 - closure level
 - other standard procedures or inputs

Nondefault

- Nondefault = anything not prescribed for general application in RISC
- Nondefault = any pertinent procedure with a valid technical or policy basis
- Benefits
 - accuracy
 - expense
 - necessity & flexibility

Nondefault (cont)

- Relatively simple or complex
- Combine default and nondefault
 - eliminate migration to ground water
 - substitute a smaller DAF in the partitioning model when subsurface source > 1/2 ac
 - use soil samples from screening or characterization for a closure demonstration

Nondefault (cont)



- Concerns
 - greater technical expertise (expense)
 - toxicologist (eg. Dermal absorption)
 - hydrogeologist (eg. Ground water modeling)
 - more site work (expense)
 - hydraulic conductivity testing for modeling

Site specific data

- Soil to ground water partitioning model
- Soil saturation limit (C_{sat})
- Soil attenuation capacity (SAC)

Soil-to-Ground Water Partitioning Model

- Migration to ground water
- US EPA Soil Screening Guidance TBD
- Assumes:
 - infinite 1/2 acre source extends to water table
 - no NAPLs
 - unconsolidated homogeneous aquifer
 - more info pg 34 SSG-TBD

$$CL = C_w \times DAF \times \left[K_d + \frac{q_w + q_a H'}{r_b} \right]$$

CL = Closure level
C_w = Closure level for ground water (constituent specific in milligrams per liter)
DAF = Dilution attenuation factor (default value is equal to 20 for 1/2 acre, and 30 for 1/4 acre, or a site-specific DF may be substituted)
DF = Dilution factor

$$CL = C_w \times DAF \times \left[K_d + \frac{q_w + q_a H'}{r_b} \right]$$

K_d = Soil-water partition coefficient

For organic compounds, *K_d* is equal to *K_{oc}* x *f_{oc}* where:

K_{oc} = Soil organic carbon-water partition coefficient (constituent specific in liters per kilogram)

f_{oc} = Organic carbon fraction of soil (default at 0.002 g/g)

Z_w = Water-filled soil porosity (default at 0.3 L water/L soil)

Z_a = Air-filled soil porosity (default at 0.13 L air/L soil)

H' = Henry's Law Constant (dimensionless)

D_b = Dry soil bulk density (default at 1.5 kg/L)

DAF

Source Size	DAF
1/4 acre or less	30
> 1/4 acre to 1/2 acre	20
> 1/2 acre to 30 acres	10

$$CL = C_w \times DAF \times \left[K_d + \frac{q_w + q_a H'}{r_b} \right]$$

Dilution Factor Equation

$$\text{Dilution Factor} = 1 + \frac{K i d}{I L}$$

$$d = (0.0112 L^2)^{0.5} + d_a \left[1 - \exp \left\{ \frac{(-L)}{(K i d_a)} \right\} \right]$$

where:

K = Aquifer hydraulic conductivity (m/yr)

i = Hydraulic gradient (m/m)

I = Infiltration rate m/yr (recharge rate m/yr)

d = Mixing zone depth (meters)

L = Source length parallel to ground water flow (meters)

d_a = Aquifer thickness (meters)

Soil-water Partition Coefficient (*K_d*)

$$CL = C_w \times DAF \times \left[K_d + \frac{q_w + q_a H'}{r_b} \right]$$

For organic compounds, *K_d* is equal to *K_{oc}* x *f_{oc}*

f_{oc} critical parameter



K_d and inorganics

- Dependent on pH, redox, cation exchange capacity, iron oxide, f_{oc}, and chemical form
- measure soil pH for metals and ionizing organics (between 6 and 8 - default ok)
- generic pH specific K_d (Table C-4 SSG-User's Guide)
- Beryllium and Mercury site specific K_d

Significance of pH on Nickel

• pH	K _d	Closure level (ppm)
4.9	16	32
6.8	65	130
8	1900	3800

Significance of pH on Mercury

• pH	K _d	Closure level (ppm)
4.9	0.04	0.002
6.8	52	2.1
8.0	200	8.1

Lead



- Default closure level is considered protective for migration to GW anywhere
- Recommend site specific evaluation using Synthetic Precipitation Leaching Procedure (SPLP, SW846 Method 1312)

Soil Saturation Limit

$$C_{sat} = \frac{S}{r_b} (K_d r_b + q_w + H' q_a)$$

Adsorptive limits soil particles
Solubility limits of soil pore water
Saturation of soil pore air

F_{oc} most sensitive criteria

SAC

- Default 6000 mg/kg surface soil
- Default 2000 mg/kg subsurface soil
- Site specific SAC = f_{oc} x 10⁶
- eg. f_{oc} = 0.7%
SAC = 0.007 g/g x 10⁶
SAC = 7000 mg/kg

Determining Site-Specific F_{oc}

- Sample beyond contaminated areas
- Composite from at least 2 borings
- More than 1 soil type use weighted ave.
- Purpose dictates approach

$$\bar{C} = \frac{\sum_{i=1}^n l_i c_i}{\sum_{i=1}^n l_i}$$

C_{ave} = Weighted avg soil conc.
 C_i = Rep soil conc in an interval
 l_i = Soil interval length
 n = Interval number

Nondefault Plume Stability

- Variations to the default:
 - using existing but incomplete ground water data (eg, some quarterly data missing for M-K trend test)
 - additional monitoring and evaluation if low % of sample results show a trend

Fate and Transport Modeling

- Select appropriate model and input parameters
- Key criteria:
 - site conditions appropriate to model limitations
 - data sufficient, documentation adequate
 - proper calibration (sensitivity/error anal.)
 - future conditions assumptions are correct

Other Pathways, Exposures, and Media (Table 7-3)

- Soil
 - vapor intrusion
- Ground Water
 - industrial process water
- Air
 - particulate and vapors in ambient air
- Surface Water
 - recreational

Other Pathways, Exposures, and Media

- Pathway Elimination
 - Direct contact pathways with presence of “permanent” physical barrier (ie asphalt)
 - Recreational pathways in surface water (if swimming prohibited or unrealistic)
 - Ingestion pathway for ground water
- Criteria: protectiveness of remedy, and effectiveness of institutional controls

Source Areas > Than 1/2 Acre

- Direct contact
 - partition into 1/2 acre increments
 - utilize procedures in 7.9.3
- Migration to ground water
 - adjust DAF (10 up to 30 acres, 1 for > 30 acres)
 - select more appropriate partitioning model

Karst and Fractured Flow

- Migration to ground water
- Ground water ingestion
 - screening
 - delineating N & E
 - closure sampling
 - plume stability

Nondefault Sampling Criteria Table 7-4

- Very general criteria
- Procedure for large complex sites (multiple source areas)

Carcinogen Target Risk Level

- 10^{-4} to 10^{-6}
- “Role of Baseline Risk Assessment in Superfund Remedy Selection Decisions”
OSWER Directive 9355.0-30
- selection based upon uncertainty



Noncarcinogen Additivity

- Demonstrate:
 - effects limited to a single organ
 - effects occur by separate nonadditive mechanisms



QUESTIONS???

